



**EUROPEAN COMMISSION**  
**INCO: International Scientific Cooperation Projects (2003 - 2006)**  
**CERAMED PROJECT / ICA3-CT-2002-10018**

**EXHIBITION OF CERAMED REPRODUCTIONS**

**Zarqa – Jordan**

**December 5-11, 2005**

**Queen Rania Institute of Tourism and Heritage /  
The Hashemite University  
Zarqa, Jordan**

**Organized by PARTNER 4: QR/JO**

# ATTIC



EUROPEAN COMMISSION / INCO CERAMED Project ICA3-CT-2002-10018 (Jan 2003 - Dec 2005)

Identification, Recovery and Improvement of Ancient Mediterranean Ceramic Manufacturing Technologies for the Reproduction of Ceramic Artefacts of Archaeological Value

Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation, 48 Vass. Constantinou Ave., 11635 Athens, Greece (www.eie.gr)

### OBJECTIVES

- Identification of the maximum yield of the production of ancient Mediterranean ceramic and ceramic manufacturing technologies, by means of scientific approaches and methods.
- Development of manufacturing processes through evaluation of archaeological methods, with respect to raw and waste materials.
- Development of knowledge.
- Non-destructive spectroscopic analysis.

### IMPLEMENTATION

- Development of non-destructive spectroscopic techniques (FTIR and XRF) for the identification of archaeological ceramics and the recovery of manufacturing technologies.
- Development of spectroscopic databases concerning the ceramic materials, by means of scientific and modern methods related to manufacturing ceramic artefacts (laboratory experiments).
- Development of scientific databases related to ceramic manufacturing processes.
- Development of safety related aspects of production of ancient ceramics of high level under laboratory or production conditions.

### NON-DESTRUCTIVE SPECTROSCOPIC TECHNIQUES

Technique	Suitable for
FTIR (ATR)	glazes
FTIR (ATR)	glaze pigments
FTIR (ATR)	raw and fired clay samples

### ACHIEVEMENTS

- Development of spectroscopic tools for determining the composition of ceramic bodies and the firing conditions employed by ancient ceramists.
- Fast and accurate identification of authentic past-firing decorations of ancient ceramics.
- Spectroscopic evaluation of lead-salt formulations established as glaze materials for lead-type earthenware.
- Development of knowledge: new data mined out, a wide-based experimental and analytical (XRF) database information is available to open public.

### REPRESENTATIVE RESULTS

- Estimation of the composition of ceramic bodies and of firing conditions employed by ancient ceramists.

IR spectra of a Hellenistic vessel body

### ATR spectra analysis of clay bodies with different granulometry

### Identification of authentic past-firing decorations of ancient ceramics

### Lead-salt formulations for lead-type ceramics

### PEOPLE INVOLVED

Researchers: E. I. Kambois (iakam@eie.gr), G. D. Chryssikos, V. Giannis, C. P. Karanika, Y. Melamris, S. Goulioti, M. Goulioti, E. Sapouni, Technical: M. Koroni, A. Vassou

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THETIS AUTHENTICS LTD, 41 M. Moussourou str., 116 36 Athens, Greece (www.thetis.gr)

### IMPROVEMENT

The production and successful marketing of "museum quality" heterogeneously authentic reproductions of ancient ceramic artefacts require a close balance between quality, authenticity, cost and marketing considerations.

### DISSEMINATION ACTIVITIES


**Educational Programs**

- 11 free-of-charge programs in collaboration with the Floriana Museum of the Athens Center May 30, June 1 & Nov 1-2 2003
- Advanced Ceramic technology from theory to practice - Organization of a three related activity with the Department of Archaeology of the University of Athens. Training of 300 four-year Archaeology students in forming, decorating and firing stoves. The results produced by the students were exhibited at the University Museum in March 2004 and form part of the above-mentioned publication.

# IZNIK




# IZNIK





**CERAMED - ICA3-CT-2002-10018**

**Identification, Recovery and Improvement of Ancient Mediterranean Ceramic Manufacturing Technologies for the Reproduction of Ceramic Artefacts of Archaeological Value**



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**Abstract**  
 Reproduction studies to produce Iznik tiles are explained and a method for manufacturing of decorative ceramic materials representing antique Iznik tile properties is described. The process of Iznik tile making has three major stages. The first stage is making of a quartz slip that is to be used as the substrate, mixing homogeneously the fine quartz with clay and flint, with following shaping and drying procedures produce the Iznik tile body. The second stage is production and application of a white slip, which is composed of fine quartz and clay firing at temperatures below 1200°C to obtain a porous substrate for under glaze decoration. The third stage is the application of colour frits, pigments and decorations with colour obtained from inorganic oxides. Finally, the last stage is the application of a fritted transparent glaze and under glaze firing is done at temperatures below 1200°C. The produced tile can be used as high quality decorative material and can find wide applications as an antique like construction material in modern buildings and in restoration works.

**STUDIES ON IZNIK WARE : LABORATORY AND WORKSHOP**

In order to perform reproduction experiments in the laboratory and ceramics atelier various samples of frit, body, slip, pigment and glaze were produced and put together to form an Iznik ware.

Recovery studies were mainly focused on frit compositions, body, slip and glaze formulations. First, various frits were being synthesized in the Laboratory, afterwards glaze formulations produced from these frits and applied on quartz based substrates. In general, glaze making, applying to a substrate and firing is studied to proceed into a full-scale prototype reproduction of a tile.

Microstructural comparisons are done between the original excavated samples and replicated samples.

As can be seen reasonable successful results were obtained for a complex structure of a multilayer Iznik ceramics with good color appearances and optical properties.

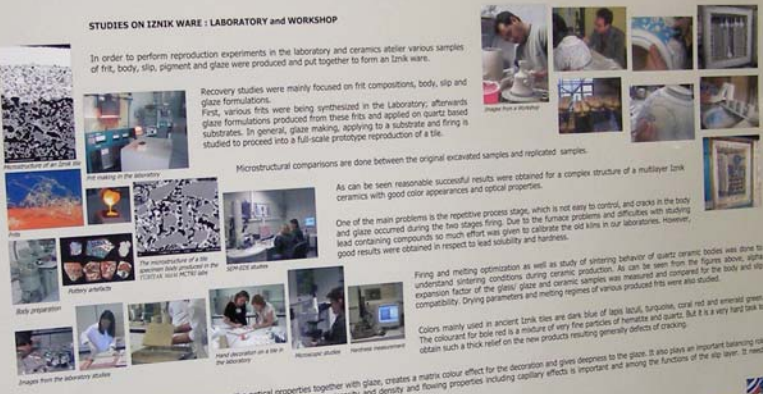
One of the main problems in the repetitive process stage, which is not easy to control, and cracks in the body and glaze occurred during the two stages firing. Due to the furnace problems and difficulties with studying lead containing compounds so much effort was given to calibrate the old kilns in our laboratories. However, good results were obtained in respect to lead solubility and hardness.


Firing and melting optimizations as well as study of sintering behavior of quartz ceramic bodies were done to understand sintering conditions during ceramic production. As can be seen from the figures above, alpha expansion factor of the glaze/ glaze and ceramic samples was measured and compared for the body and slip compatibility. Drying parameters and melting regimes of various produced frits were also studied.

Colors mainly used in ancient Iznik tiles are dark blue of lapis lazuli, turquoise, coral red and emerald green. The colourant for base red is a mixture of very fine particles of hematite and quartz. But it is a very hard task to obtain such a thick red on the new products resulting generally defects of cracking.

The production of slip layer is so important and it gives the optical properties together with glaze, on the matching of the composition between the glaze and body. Of course its viscosity and density and flowing properties including capillary effects is important and among the functions of the slip layer. It needs continuous stirring during the production.

Polychrome slip type Iznik ware such as turquoise, pink beige and blue background is also produced during the research studies.





**Partners**

- Partner 1-TPCJ  
Theoretical and Physical Chemistry Institute, Ankara, Turkey
- Partner 2-ERACB  
Equipe de Recherche Archéologique, Université de Bordeaux (Bordeaux, France)
- Partner 3-MCTRI  
Materiais Cerâmicos, Universidade Federal do Rio de Janeiro (Rio de Janeiro, Brazil)
- Partner 4-ORITM  
Orta Anadolu Kültür Varlıklarını Koruma ve Onarım Birliği - The Historical Ceramics Center, Istanbul, Turkey
- Partner 5-ML  
Faculté de Lettres et Sciences Humaines - Université Mohammed El Bacha Masmoudi, Algiers, Algeria
- Partner 6-TIETIS  
Türk İznikçileri Cemiyeti (Iznik, Turkey)

# NABATAEAN

